

Increased Incidence of Influenza: Effects of Dense Housing Occupancy, Behaviour and Demographic Factors in Coastal Areas: A Cross-Sectional Study

Peningkatan Kejadian Influenza: Efek Hunian Rumah Padat, Perilaku dan Faktor Demografi di Wilayah Pesisir: Studi Cross Sectional

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Abstract

Introduction: Influenza is an acute respiratory infection that is a seasonal pandemic and can be prevented by healthy behaviours. However, the fact is that influenza cases are still often outbreaks, even epidemics, both nationally and globally. **Purpose:** To assess demographic determinants, occupancy density, and preventive behaviour with influenza incidence in the coastal area of Bungkutoko sub-district of Kendari city, in one of the islands of Southeast Sulawesi, Indonesia. **Methods:** A cross-sectional study involving 95 respondents selected by simple random sampling was used as a research design. Structured interviews used valid and reliable questionnaires to obtain data on age, sex, preventive behaviour, and occupancy density. The chi-square test was used to analyse bivariates with a significant value of 0.05. **Results:** More than half (53.7%) of influenza cases were found out of 95 respondents. Age ($p=0.002$; $OR= 3.251$), gender ($p=0.041$; $OR=2.133$), preventive behaviour ($p=0.047$; $OR=2.163$), and dense housing occupancy ($p=0.0001$; $OR= 5.775$) was significantly associated with influenza ($\alpha < 0.05$). **Conclusion:** Influenza cases are associated with increased risk factors for age, sex, preventive behaviour, and dense housing occupancy in coastal areas in this study. Thus, increased education on influenza prevention by paying attention to risk factors by community and interprofessional nurses is needed as early awareness of the potential for an epidemic.

Abstrak

Latar belakang: Influenza merupakan penyakit infeksi saluran pernapasan akut yang pandemik musiman dan dapat dicegah dengan perilaku hidup sehat. Namun, kenyataannya kasus influenza masih sering menjadi outbreak, bahkan epidemic baik nasional maupun global. **Tujuan:** Untuk menilai determinan demografi, kepadatan hunian, dan perilaku pencegahan dengan kejadian influenza di wilayah pesisir kelurahan Bungkutoko kota Kendari, di salah satu kepulauan Sulawesi Tenggara, Indonesia. **Metode:** Studi *cross-sectional* digunakan sebagai desain penelitian, melibatkan 95 responden yang dipilih dengan simple random sampling. Wawancara terstruktur menggunakan kuesioner yang valid dan reable untuk memperoleh data usia, jenis kelamin, perilaku sehat, dan kepadatan hunian. Uji *chi square* digunakan untuk menganalisis bivariat dengan nilai signifikan 0,05. **Hasil:** Ditemukan setengah lebih (53,7%) kasus influenza dari 95 responden. Usia ($p=0,002$; $OR= 3,251$), jenis kelamin ($p=0,041$; $OR=2,133$), perilaku hidup sehat ($p=0,047$; $OR=2,163$), dan kepadatan hunian ($p=0,0001$; $OR= 5,775$) berhubungan secara signifikan terhadap kejadian influenza ($\alpha < 0,05$). **Simpulan:** Kasus influenza terjadi peningkatan berhubungan dengan faktor risiko usia, jenis kelamin, perilaku pencegahan, dan kepadatan hunian di daerah pesisir pada studi ini. Sehingga, mengindikasikan peningkatan edukasi pencegahan kejadian influenza dengan memperhatikan faktor risiko oleh perawat komunitas dan interprofessional sangat diperlukan sebagai kewaspadaan dini potensi terjadi epidemic.

Introduction

Changes in contact and mobility patterns due to lockdowns and quarantines related to travel restrictions in several countries since the beginning of 2020 have affected the seasonal cycles of

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many infectious diseases, including influenza (Lee et al., 2022). Influenza is an acute respiratory infectious disease transmitted to humans and animals, generally caused by influenza type A and influenza type B viruses. This virus could be an annual seasonal epidemic and sporadic pandemic outbreaks (Krammer et al., 2018; Markowitz et al., 2010). Influenza is a significant burden on public health (Álvarez et al., 2019) and public health issues of national importance, regionally and globally, as they are causes of severe mortality and morbidity throughout the year (Elhakim et al., 2020).

Influenza spreads indefinitely, so worldwide, it has infected about 5-10% of adults and 20-30% of children annually (Petrova & Russell, 2018). WHO (2023) reports seasonal influenza cases of about one billion annually, including 3–5 million cases of severe illness. The virus annually causes 290,000 to 650,000 deaths from acute respiratory infections. In developing countries, there are 99% of deaths of children under the age of 5 years due to lower respiratory infections due to influenza, including Indonesia. This study conducted in the archipelago of Southeast Sulawesi province, Indonesia reported that the spread of influenza from 17 regencies/cities had an increasing trend in the last three years from 2020-2022; in 2021, there were 4295 cases, increasing to 18,047 in 2021 and 2022 (Dinas Kesehatan Sulawesi Tenggara, 2022). In the city of Kendari, part of this province, the spread of Influenza cases in 2022 is high compared to other disease cases because it ranks fourth with 1321 cases and is in a tropical region (Dinas Kesehatan Kota Kendari, 2022).

Influenza is influenced by climate and geographical location. If the state of sporadic outbreaks, an increase in influenza illness can occur during winter or other seasons with clinical manifestations as acute febrile illness with varying degrees of systemic and respiratory symptoms (Krammer et al., 2018). In tropical regions, such as Indonesia, influenza can occur in all seasons, allowing outbreaks to happen every season (Tamerius et al., 2011), including Kendari City and Southeast Sulawesi province. Indonesia is a country located on the equator, shows circulation throughout the year, and does not have a clear peak (Lampros et al., 2023) Because it tends to span the same season between the rainy season and the dry season (Sarmin et al., 2020).

Previous studies have been conducted to identify various risk factors for increased cases of influenza. Factors include dense house occupancy, unhealthy behaviour, nutritional status, smoking habits in the family, state of the home environment, and climate. In addition, age factors and gender are some of the causes or risk factors for increasing cases of influenza and respiratory infections. (Putri, 2021; Hartawan et al., 2020; Salimah, 2021; Sarmin, 2020; Syahrir et al., 2021; Prayoga et al., 2023; Firza et al., 2020, & Kaur et al., 2020). Although research on the determinants of influenza incidence has been conducted, this study focuses on studies in coastal areas with tropical climates by examining variables of community behaviour and residential occupancy. Age and gender factors are included as internal body factors related to the immune system. At the location of this study, one of the Bungkutoko villages is located in the coastal area, making conditions in this area greatly influenced by weather changes that also affect the spread of influenza viruses. Thus, an investigation into influenza outbreak cases is needed. Therefore, this study aims to assess demographic factors (age and gender), community behaviour, and house occupancy density and whether they affect the incidence of influenza in the Bungkutoko sub-district. Knowing the determinants of the results of this study can inform an efficient and effective strategy for preventing influenza cases. Thus, this research is essential for planning and developing influenza prevention strategies in specific communities in coastal areas.

Methods

This quantitative research uses a cross-sectional study approach, where studies with data measurements or observations are carried out once simultaneously between independent and front variables (Syahrir et al., 2021), which was implemented in July – August 2023. This study was used to answer demographic factors, healthy behaviour, and dense housing occupancy with increased influenza cases. As a research sample, the study involved 95 community respondents in the Bungkutoko sub-district, Kendari City. The minimum sample size is calculated using the Slovin formula, whereas the sample selection uses the Simple Random Sampling technique. All communities living in the Bungkutoko sub-district area were included in the sample. People with mental problems and/or unable to communicate during interviews when data collection were excluded from the study.

Data collection using a structured interview method with a questionnaire measuring instrument. Valid and reliable questionnaires were developed from research by Haryani and Misniarti (2021) and used to obtain data on influenza disease and several influencing factors. The results of measuring the incidence of influenza disease as a dependent variable are categorised as influenza disease and not influenza based on medical diagnosis. The independent variables consist of (1) Gender with male and female measuring results; (2) The age of respondents with measuring results is at risk if the age < 18 years, and not at risk if the age ≥ 18 years; (3) Respondents' healthy behaviour is measured by "Yes" and "No" categories. The criteria for healthy behaviour if respondents do ten questions consist of indicators, namely handwashing behaviour, sneezing etiquette, eating and drinking patterns, rest patterns, strategies in maintaining health, and smoking habits; and (4) dense house occupancy with the measurement results of "Yes," if the area of the house, and the number of occupants ≤ 8 m² per 2 people and "No," if the location of the house, and the number of occupants < 8 m per 2 people.

Univariate analysis was carried out on each research variable, including the characteristics of research respondents in frequency distribution. Analysis of bivariate data using the chi-square test to prove the determinants of influenza disease incidence. This research has received an Ethics feasibility test from Mandala Waluya University, Kendari, Indonesia, with Number 0258/UMW.08/VIII/ 2023, and obtained a permit from the research site. Each respondent is informed about the study's primary purpose, and they have the full right to refuse to participate. Informed consent is obtained from all respondents who agree in writing.

Results

Descriptions of Research Subjects

The study involved 95 research subjects. Table 1 shows that of the 95 dominant people, 80% were over ≥ 18 years old, 52.6% were female sex, 75.8% had healthy behaviour, and 53.7% had dense house occupancy. Meanwhile, 53.7% of the 95 study subjects had influenza.

Analysis Results

The results of statistical tests showed that there was a relationship between age and sex factors with influenza incidence, with each p-value = 0.002 (OR 3.251; CI 95%: 2.714 - 12.213) and 0.041 (OR 2.133; CI 95%: 6,452 - 12,394). There was an association of unhealthy behavioural factors with influenza incidence (p-value = 0.047; OR 2.163; CI 95%: 4.456 - 8.914), and there is a dense house

occupancy (p-value = 0.000; OR 5,775; CI 95%: 2.344 - 14.233) relationship with influenza incidence (Tabel 2).

Table 1.

Descriptive of study subjects and incidence of influenza (n = 95)

Characteristics	Variable	Frequency (n=95)	% (n=100%)
Age	< 18 years old	19	20
	≥ 18 years old	76	80
Gender	Man	45	47,4
	Woman	50	52,6
Healthy living behaviour	The	72	75,8
	No	23	24,2
Dense house occupancy	The	51	53,7
	No	44	46,3
The occurrence of influenza	The	51	53,7
	No	44	46,3

Table 2.

Results of independent variable relationship analysis with the incidence of influenza disease

Variable	Incidence of Influenza Disease				Sum		OR (CI 95%)	P-value
	Yes		No					
	n	%	n	%	n	%		
Age								
< 18 years old	15	78,9	4	21,0	19	20	3,251 (2,714 - 12,213)	0,002
≥ 18 years old	29	38,1	47	61,8	76	80		
Gender								
Man	26	57,5	19	42,2	45	32,6	2,133 (6,452 - 12,394)	0,041
Woman	18	36	32	64	50	64,7		
Healthy behavior								
Yes	34	47,2	38	52,7	72	65,3	2,163 (4,456 - 8,914)	0,047
Not	10	43,4	13	56,5	23	34,7		
Dense house occupancy								
Yes	27	52,9	11	21,5	51	53,7	5,775 (2,344 - 14,233)	0,000
Not	17	38,6	40	90,9	44	46,3		

Discussion

This study involved 95 participants who aimed to evaluate several risk factors associated with the incidence of influenza. The results showed that demographic characteristics, age, and gender, as well as unhealthy behaviours and dense housing occupancy, were associated with the incidence of influenza.

Participants exposed to influenza aged ≤ 18 years were more dominant. The age ≤ 18 years is statistically at greater risk (OR=3.251) than the age not at risk, which is > 18 years. Study results by Peters et al. (2014) confirmed that the age range of confirmed school-age children was more likely to come to the emergency department or be hospitalised early due to influenza during the three surveillance seasons. This situation occurs with the possibility of transmission from surrounding people through the air or direct contact. Children's immune system is still more susceptible to infection with the virus than adults. As a result, children or young age are more easily infected with viruses, such as influenza (Iskandar, et al., 2015). In addition, the analysis results found that 21.0% of participants ≤ 18 years did not have influenza, and > 18 years there were 38.1% of participants were exposed to influenza, possible overcrowding factors, and unhealthy behaviour, as the results of this study showed a significant association. This study is consistent with previous research reports that age is associated with the incidence of other viral infections, such as COVID-19 (Putri et al., 2021) and Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Lee et al., 2022). Efforts to prevent

an increase in influenza infections are essential to foster a healthy life and maintain transmission to residents living in the environment and dense housing occupancy.

The biological characteristics of women and men from birth have differences (Suhardin, 2016), and having a different immune system affects the body's defence against disease (Firza et al., 2020). The results of this study showed the incidence of influenza with the male sex more dominant experiencing influenza. Gender is significantly associated with the incidence of influenza cases. Men are 2,133 times more likely to be exposed to influenza cases than women. In this situation, it is expected that men are more often active outside the home than outside the house and have the potential to have direct contact with influenza sufferers. This study is in accordance with previous research reports that elderly and adult types of men, compared to women, are more at risk of being exposed to covid-19 by (Nur et al., 2023) and exposed to influenza virus infection (Sari & Ardiansah, 2017). Female sex, compared to male in anatomical form, there are differences in physiology and hormonal systems. In addition, due to work, lifestyle, exposure, vulnerability, and use of primary health services, women visit more frequently than men (Firza et al., 2020). Prevention of increased influenza incidence is important by behaving in a healthy life, such as using masks when outside the home, washing hands, applying sneezing etiquette, and maintaining distance according to the conditions of influenza spread.

Health behaviour is related to maintaining and improving health (Andin et al., 2021). The results of this study prove that unhealthy behaviour is associated with the incidence of influenza. The associated risk for exposure to influenza cases was 2,163 times in participants who behaved unhealthily compared to healthy ones. This research aligns with previous research by Prayoga et al. (2023). Healthy behaviours, such as washing hands using clean and running water and rubbing hands with soap, can eliminate bacteria and viruses on the hands and prevent the spread of influenza (Nakoe et al., 2020).

However, 47.2% of participants who behaved healthy were exposed to influenza, and 56.5% behaved unhealthily not exposed to influenza. This situation is possible due to other risk factors not analysed in this study. H. L Bloom explained that in addition to behavioural factors, diseases or public health degrees are influenced by the environment, health services, and heredity (Juwita, 2021). Therefore, efforts to improve public health to be free from influenza require significant attention, according to the findings of this study by the community, community caregivers, and interprofessionals.

Another risk factor for increased health or incidence of influenza is the environment, such as dense house occupancy (Putri, 2021). The findings of this study prove that there is a relationship between dense house occupancy and influenza incidence. Participants who lived in crowded dwellings were 5.7 times more likely to be exposed to influenza cases than those who lived in non-crowded dwellings. In line with research by Hartawan et al. (2020), acute respiratory tract infections are associated with dense house occupancy. The more house residents gather in a room, the more likely they are to be exposed to respiratory diseases. Dense house occupancy allows bacteria and viruses to be transmitted between house residents through breathing. In fact, according to H. L. Bloom, environmental factors are the most dominant factors affecting the degree of health in the community, in addition to behavioural, health service, and genetic factors (Juwita, 2021). This situation will likely cause some participants (38.6%) to live in uncrowded houses, and 21.5% live in crowded houses but are exposed to influenza infection.

The floor building area of the house is healthy if the number of occupants does not cause overload or overcrowding, thus preventing a lack of supply for oxygen consumption. The number of residents of houses that meet health requirements for residence if they meet the minimum area of 8 m² / person (Effendi et al., 2020). The more residents there are, the faster the air in the house is polluted because carbon dioxide levels can increase and reduce oxygen levels (Yuslinda et al., 2017). A sizeable residential occupancy of at least ≥ 8 m² is an effort to prevent respiratory infections in the community, especially if family members are experiencing illness. However, this study has not examined the home's physical condition, such as ventilation and lighting, which are likely variables confounding the incidence of influenza infection in the house, thus minimising the bias of the results.

Conclusion

Increased acute respiratory infections, such as influenza, are associated with various risk factors. The study found that demographic factors, namely age and gender, unhealthy behaviour, and dense housing occupancy, are triggers that increase the incidence of influenza virus infection. Therefore, the results of this study indicate that community nurses and interprofessional develop intervention plans that consider unhealthy behaviours in the community and crowded housing occupancy so that they can efficiently and effectively prevent and reduce influenza cases, specifically in coastal areas. We recommend that studies examine other variables that influence the spread of influenza virus infection, such as ventilation effects, lighting, and other factors, with further analysis.

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